

ABSTRACT OF THE DISCLOSURE

Described herein is a method for constructing a multipurpose error-control code for multilevel memory cells operating with a variable number of storage levels, in particular for memory cells the storage levels of which can assume the values of the set $\{b^a, b^{a_1}, \dots, b^{a_1 \dots a_n}\}$, with b, a_1, \dots, a_n positive integers; the error-control code encoding information words, formed by k q -ary symbols, *i.e.*, belonging to an alphabet containing q different symbols, with $q \in \{b^a, b^{a_1}, \dots, b^{a_1 \dots a_n}\}$, in corresponding code words formed by n q -ary symbols, with $q=b^{a_1 \dots a_n}$, and having an error-correction capacity t , each code word being generated through an operation of multiplication between the corresponding information word and a generating matrix. The construction method comprises the steps of: acquiring the values of $k, t, b^a, b^{a_1}, \dots, b^{a_1 \dots a_n}$, which constitute the design specifications of said error-control code; calculating, as a function of $q=b^a, k$ and t , the minimum value of n such that the Hamming limit is satisfied; calculating the maximum values \hat{n} and \hat{k} respectively of n and k that satisfy the Hamming limit for $q=b^a, t$ and $(\hat{n}-\hat{k})=(n-k)$; determining, as a function of t , the generating matrix of the abbreviated error-control code $(n-k)$ on the finite-element field $GF(b^a)$; constructing binary polynomial representations of the finite-element fields $GF(b^a), GF(b^{a_1}), \dots, GF(b^{a_1 \dots a_n})$; identifying, using the aforesaid exponential representations, the elements of the finite-element field $GF(b^{a_1 \dots a_n})$, which are isomorphic to the elements of the finite-element fields $GF(b^a), GF(b^{a_1}), \dots, GF(b^{a_1 \dots a_n})$; establishing biunique correspondences between the elements of the finite-element fields $GF(b^a), GF(b^{a_1}), \dots, GF(b^{a_1 \dots a_n})$ and the elements of the finite-element field $GF(b^{a_1 \dots a_n})$ that are isomorphic to them; and replacing each of the elements of said generating matrix with the corresponding isomorphic element of the finite-element field $GF(b^{a_1 \dots a_n})$, thus obtaining a multipurpose generating matrix defining, together with the aforesaid biunique correspondences, a multipurpose error-control code that can be used with memory cells the storage levels of which can assume the values of the set $\{b^a, b^{a_1}, \dots, b^{a_1 \dots a_n}\}$.